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Effect of Abiotic Factors on Seasonal Incidence of Sucking Pests on Chilli

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ABSTRACT: A field experiment was conducted at experimental farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during the *kharif* season 2022-23 to study seasonal incidence of sucking pests on chilli in relation to weather parameters. The experiment was conducted in unprotected plot which was non- replicated. The observations on seasonal incidence of aphids, thrips, whiteflies, leaf hoppers were recorded. Aphids and leaf hoppers activity commenced in second week of August, while, thrips and whiteflies activity started in first week of August. The peak activity of aphids was observed during last week of August (14.60 aphids/3 leaves), whereas, thrips reached peak during September third week (17.20 thrips/3 leaves). Further, whiteflies and leaf hoppers reached peak (8.80 whiteflies/3 leaves) and (6.60 hoppers /3 leaves), respectively during September second week. The aphids showed non-significant negative correlation with rainfall and morning relative humidity, while non-significant positive correlation with maximum temperature, minimum temperature, evening relative humidity and wind speed. The thrips showed non-significant negative correlation with rainfall, while non-significant positive correlation with the maximum temperature, minimum temperature, evening relative humidity and wind speed. The whiteflies showed non-significant positive correlation with the rainfall, maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and wind speed. The leaf hoppers population showed non-significant negative correlation with maximum temperature, while non-significant positive correlation with the rainfall, minimum temperature, evening relative humidity and wind speed etc.

Keywords: Correlation, aphids, thrips, whiteflies, leaf hoppers, *Capsicum annum.*

INTRODUCTION

Chilli (*Capsicum annum* L.) belongs to family Solanaceae. It is the most important commercial and valuable spice crop grown throughout the world. Chilli is native to Mexican region. It is well known for its medicinal uses. India is chief grower and exporter of chilli in world. The main purposeful properties of chilli are pungency, antioxidant activity, vitamin C, oleoresin and natural pigments.

India is the largest producer as well as consumer of chilli in world with the production 13.84 lakh MT (Agriwatch 2021-22) but its production pattern is highly erratic. In India, according to 2019-20 first advance estimates, chilli occupies an area of 7.33 lakh hectares with the production of 17.64 lakh tones and productivity of 2400 kg/ha. In India, Karnataka ranks first in terms area and production of chilli. It covers an area of 45.4 thousand hectares and production of 607.94 thousand tonnes (NHB 2017), respectively. Other chilli growing states in country are Madhya Pradesh, Andhra Pradesh, Bihar, Maharashtra and Chattisgarh. Our country is largest producer of dry chilli in the world (FAO, 2012).

Many factors are responsible for low production and productivity of chilli crop that include biotic factors like the incidence of insect's pests and diseases. Orobiyi *et al.* (2013) conducted a survey in Benin, to find out production constraints for chilli, ranking the threat of insect pests on flowers, leaves and fruits among all constraints as first. Another survey by the Asian Committee for Vegetable Research and Development (Reddy and Puttaswamy 1983) in Asia determined the key insect pests of chilli were thrips (*Scirtothrips dorsalis* Hood), aphids (*Aphis gossypii* Glover) and yellow mite (*Polyphagotarsonemus latus* Banks) which act as limiting factors in chilli production.

More than 39 genera and 51 species of insects and mites have been reported to cause damage to chilli crop in the field as well as in storage including aphid, whitefly, jassids, thrips, cutworm, mealy bug and fruit borer. But aphids, thrips and whitefly are considered as most devastating sucking pests on chilli. These sucking pest insects cause damage both directly and indirectly. Among them, aphids can accumulate in high densities on young tender parts of the plants and suck cell sap from the leaf and other parts of the plant resulting in leaf curling or twisting, yellowing, dry up and finally dropping down. Excessive honey dew secretion can

lead to the production of sooty moulds that affects the photosynthesis of plant and decreases the market value of the fruits. Thrips remove the material from the epidermal cells, causing the tissue necrosis. Also, internal area eruption, leaf puckering and upward leaf curling are also noted (Reddy and Puttaswamy 1983). They also act as an important vector of different viruses like chilli leaf curl virus (CLCV) also referred to as "Churda – Murda" disease.

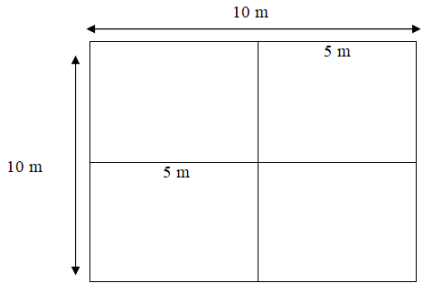
Whitefly damages in plant in many ways, it causes chlorosis, premature leaf fall and wilting leaf withering, excreting honey dew which leads to sooty mould development, thus reducing photosynthesis and leaf area. Chilli shoot and fruit borer, *Helicoverpa armigera* Hubner is a polyphagous pest of chilli. It is observed to damage the fruit capsules, particularly boring near the stalk and destroying the content. Tobacco leaf eating caterpillar, *Spodoptera litura* F is another borer found on chilli crop, it is also a polyphagous pest and damages by making a hole in the leaves, scratching the young shoots and feeding on the fruits.

The incidence of sucking pest on chilli crops varied due to several factors like planting time, variety, and most important abiotic factors. Different abiotic factors like temperature, humidity and rainfall plays an important role on the incidence and population dynamics of sucking pest. So determining the link between the population of pests and various abiotic environmental factors proves to be helpful in formulating an effective strategy for pest management.

MATERIAL AND METHODS

The experiment was conducted in unprotected plot which was non- replicated at experimental field of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. In order to study the effect of abiotic factors on the incidence of major sucking insect pests on chilli, four separate plots of 10.00 × 10.00 meters size keeping row to row and plant to plant distance of 60 × 45 cm, respectively were maintained. The variety Parbhani Tejas was transplanted on 20th July, 2022.

The observations on population of leafhopper, whitefly and thrips were recorded after one week transplanting. All the observations were recorded early in the morning. Leafhopper, population was recorded on each five randomly selected and tagged plants in each plot. Three leaves, viz., one each from top, middle and lower canopy of the plants were taken into account for recording the leafhopper population. Whitefly, population of was recorded by counting the nymphs and adults on five randomly selected plants permanently tagged in each plot. Three leaves, viz., one each from top, middle and lower canopy of the plants were taken into account to record the populations. Thrips, population of was recorded on each five randomly selected and tagged plants in each plot. Three leaves, *viz.*, one each from top, middle and lower canopy of the plants were taken into account for recording the thrips population.



Plan of layout for seasonal incidence of sucking pests on chilli.

RESULTS AND DISCUSSION

The data presented in Table 1 revealed that insect pest species, viz., aphids, leafhopper, whitefly and thrips were recorded on three leaves were recorded during the crop seasons, *Kharif*, 2022. The findings of the present study and the related discussion are explained hereunder.

A. Population of sucking pests complex

Weekly observations were recorded from transplanting to maturity of the crop. Observations on pests incidence initiated from August 2022 and continued up to November 2022. Studies on population dynamics of insect pests revealed that sucking pests were observed to be associated with various stages on chilli crop.

(i) Population of aphids in chilli: The observations recorded on the population dynamics of aphids in chilli tabulated in (Table 1) reveals that the population of aphids initiated in the 2nd week of August *i.e.,* 32nd SMW with the mean population of (2.80 aphids/3 leaves) and remained upto 2nd week of November *i.e.*, 45th SMW with the mean population of (1.20 aphids/3 leaves). The population of aphids gradually increased and reached its peak with a mean of (14.60 aphids/3 leaves) during last week of August *i.e.*, 35th SMW during *kharif* 2022 when maximum and minimum temperature recorded were 32.6°C and 22.5 °C, morning and evening humidity were 75.00 per cent and 46.00 per cent and rainfall was 3.6 mm.

The correlation analysis of the population of aphids per three leaves with weather parameters *viz*., rainfall, temperature, humidity and wind speed reveal that the number of aphids per three leaves exhibited non-significant negative correlation with rainfall (r = -0.114) and morning relative humidity (r = -0.010). The maximum temperature (r = 0.496), minimum temperature (r = 0.467), evening relative humidity (r = 0.285) and wind speed (r = 0.402) showed non-significant positive correlation with the number of aphids per three leaves.

The results of the present finding are in accordance with the findings of Kumawat *et al*. (2015); Havanoor and Rafee (2018); Butani (1970); Prathyusha *et al*. (2021). Kumawat *et al*. (2015) also observed that the high incidence of aphids (11.93 aphids/3 leaves) during 35th SMW *i.e.,* last week of August, which might be due to local weather conditions that prevailed during the study period. Butani (1970) reported the appearance of aphid from July to till harvest. Havanoor and Rafee (2018) who reported non-significant positive

correlation between aphids population and maximum temperature, similar results were also obtained by Prathyusha *et al*. (2021) who observed non-significant negative correlation between aphids population and rainfall, while non-significant positive correlation with minimum temperature and evening relative humidity.

(ii) Population of thrips in chilli: The observations recorded on the population of thrips in chilli tabulated in (Table 1) reveals that the population of thrips initiated in the 1st week of August *i.e.,* 31st SMW with the mean population of (1.20 thrips/3 leaves) and remained upto 2nd week of November *i.e.*, 45th SMW with the mean population of (1.60 thrips/3 leaves). The population of thrips gradually increased and reached its peak with a mean of (17.20 thrips/3 leaves) during third week of September *i.e.*, 38th SMW during *kharif* 2022 when maximum and minimum temperature recorded were 30.7°C and 21.4°C, morning and evening humidity were 95.00 per cent and 81.00 per cent and rainfall was 9.3 mm.

The correlation analysis of the population of thrips per three leaves with weather parameters *viz.*, rainfall, temperature, humidity and wind speed reveal that the number of thrips per three leaves exhibited non-significant negative correlation with rainfall (r = -0.098), while non-significant positive correlation with the maximum temperature (r = 0.159), minimum temperature (r = 0.360), evening relative humidity (r = 0.501) and wind speed (r = 0.485). The morning relative humidity (r = 0.586) had a significant positive correlation with the number of thrips per three leaves.

The findings of the present investigations get full support from the results obtained by Saini *et al.* (2017); Kumawat *et al*. (2015); Prathyusha *et al*. (2021); Tirkey *et al*. (2020). Saini *et al*. (2017) who observed the peak population of thrips during the third week of September *i.e.,* 38th SMW (10.20 thrips per 3 leaves) and also reported non-significant negative correlation between thrips population and rainfall. Kumawat *et al*. (2015) reported the highest incidence of thrips in the 40th SMW and the population was non-significant negative correlated with rainfall. Prathyusha *et al*. (2021) observed that thrips showed non-significant positive correlation with maximum temperature while, non-significant negatively correlated with rainfall. Similarly, Tirkey *et al*. (2020) revealed that thrips had non-significant positive correlation with maximum temperature.

(iii) Population of whiteflies in chilli: The observations recorded on the population of whiteflies in chilli tabulated in (Table 1) reveals that the population of whiteflies initiated in the 1st week of August *i.e.,* 31st SMW with the mean population of (1.40 whiteflies/3 leaves) and remained upto 2nd week of November *i.e.*, 45th SMW with the mean population of (1.20 whiteflies/3 leaves). The population of whiteflies gradually increased and reached its peak with a mean of (8.80 whiteflies/3 leaves) during second week of September *i.e.*, 37th SMW during *kharif* 2022 when maximum and minimum temperature recorded were 30.0 °C and 21.8 °C, morning and evening humidity were 94.00 per cent and 74.00 per cent and rainfall was 35.8 mm.

The correlation analysis of the population of whiteflies per three leaves with weather parameters *viz.*, rainfall, temperature, humidity and wind speed reveal that the number of whiteflies per three leaves exhibited non significant positive correlation with the rainfall (r = 0.059), maximum temperature (r = 0.003), minimum temperature (r = 0.343), morning relative humidity (r = 0.513), evening relative humidity (r = 0.509) and wind speed (r = 0.182).

The present results are in the line with the findings of Saini *et al*. (2017) who reported that peak population of whitefly during the second week of September *i.e.,* 37th SMW (6.80 whitefly per 3 leaves) and non-significant positive correlation between whitefly population and rainfall. The obtained results also confirm with the findings of Kumawat *et al*. (2015) who observed the peak activity of whitefly during third week of September, this might be due to variable climatic conditions of that particular region and time of cultivation of the crop and reported non-significant positive correlation between whitefly population and rainfall.

(iv) Population of leaf hoppers in chilli: The observations recorded on the population of leaf hoppers in chilli tabulated in (Table 1) reveals that the population of leaf hoppers initiated in the 2nd week of August *i.e.,* 32nd SMW with the mean population of (1.20 hoppers/3 leaves) and remained upto 2nd week of November *i.e.*, 45th SMW with the mean population of (1.40 hoppers/3 leaves). The population of leaf hopper gradually increased and reached its peak with a mean of (6.60hoppers/3 leaves) during second week of September *i.e.*, 37th SMW during *kharif* 2022 when maximum and minimum temperature recorded were 30.0°C and 21.8°C, morning and evening humidity were 94.00 per cent and 74.00 per cent and rainfall was 35.8 mm.

The correlation analysis of the population of leaf hoppers per three leaves with weather parameters *viz.*, rainfall, temperature, humidity and wind speed reveal that the number of leaf hoppers per three leaves exhibited non significant negative correlation with maximum temperature (r = -0.106), while non-significant positive correlation with the rainfall (r = 0.376), minimum temperature (r = 0.303), evening relative humidity (r = 0.478) and wind speed (r = 0.142). The morning relative humidity (r = 0.555) had a significant positive correlation with the number of leaf hoppers per three leaves.

The present findings are in conformity with Saini *et al.* (2017) who observed the peak population of leaf hoppers during the second week of September *i.e.*, 37th SMW (5.40 hoppers/3 leaves), which might be due to local weather conditions that prevailed during the study period. The results of the present study are not parallel with the studies of Kumawat *et al*. (2015); Saini *et al.* (2017) who found rainfall was non-significant negatively correlated with population of hoppers.

Table 1: Population of sucking pests in Chilli and its relation with weather parameters during *Kharif*, 2022-2023.

Date and Month	SMW	Weather parameters						Mean population of sucking pests complex /3 leaves			
		Max. Temp. (°C)	Min. Temp. (°C)	Morning Relative Humidity (%)	Evening Relative Humidity (%)	Total Rainfall (mm)	WS (Kmph)	Aphid	Thrips	Whitefly	Leaf hoppers
30th Jul – 5th Aug	31	31.7	23.0	87	62	12.3	2.8	0.00	1.20	1.40	0.00
06th - 12th Aug	32	28.9	22.5	88	73	48.8	4.0	2.80	3.20	1.80	1.20
13th - 19th Aug	33	30.2	21.8	87	65	6.0	4.0	5.40	4.40	2.40	1.80
20th - 26th Aug	34	31.6	22.3	85	58	6.6	4.7	9.60	7.80	2.80	2.40
27th Aug -02nd Sep	35	32.6	22.5	75	46	3.6	3.0	**14.60**	6.60	4.60	3.20
03rd -0 9th Sep	36	30.7	22.3	92	68	120.4	2.9	4.20	2.20	3.80	4.60
10th - 16th Sep	37	30.0	21.8	90	74	35.8	2.9	7.40	9.80	**8.80**	**6.60**
17th– 23rd Sep	38	30.7	21.4	95	81	9.3	4.5	9.80	**17.20**	7.60	5.40
24th - 30th Sep	39	32.0	21.2	92	58	47.4	3.2	11.20	12.20	5.20	3.20
01st - 07th Oct	40	31.8	21.4	88	56	11.0	4.3	12.60	8.80	3.60	3.60
8th - 14th Oct	41	31.0	22.1	91	64	57.1	2.7	6.20	6.20	1.20	2.20
15th– 21st Oct	42	30.3	21.6	91	62	87.8	3.5	3.20	4.40	2.40	4.20
22th - 28th Oct	43	30.7	14.2	86	26	0.0	3.1	1.80	2.60	1.80	1.80
29th Oct -04th Nov	44	30.7	12.9	86	28	0.0	3.0	1.40	2.20	1.60	1.60
05th - 11th Nov	45	31.5	12.6	83	25	0.0	2.7	1.20	1.60	1.20	1.40
Coefficient of correlation for population and max temperature								0.496	0.159	0.003	-0.106
Coefficient of correlation for population and min temperature								0.467	0.360	0.343	0.303
Coefficient of correlation for population and morning relative humidity								-0.010	**0.586***	0.513	**0.555***
Coefficient of correlation for population and evening relative humidity								0.285	0.501	0.509	0.478
Coefficient of correlation for population and Wind speed								0.402	0.485	0.182	0.142
Coefficient of correlation for population and Rainfall								-0.114	-0.098	0.059	0.376

SMW-Standard meteorological weeks, *Significant at 5 per cent level

CONCLUSIONS

The population of aphids showed non-significant negative correlation with rainfall, morning relative humidity and non-significant positive correlation with maximum temperature, minimum temperature, evening relative humidity and wind speed. The thrips population showed non-significant negative correlation with rainfall, while non-significant positive correlation with the maximum temperature, minimum temperature, evening relative humidity and wind speed. The whiteflies population showed non significant positive correlation with the rainfall, maximum temperature, minimum temperature morning relative humidity, evening relative humidity and wind speed and leaf hoppers population showed non significant negative correlation with maximum temperature, while non-significant positive correlation with the rainfall, minimum temperature, evening relative humidity and wind speed.

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Conflict of Interest. None.

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